

***Saurauia* (Actinidiaceae) of New Guinea: current status, future plans**

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ABSTRACT. *Saurauia*, with approximately 300 species, is the largest of three genera within the family Actinidiaceae and is found in the tropical and sub-tropical regions of Asia, Central and South America. The family placement of the genus has changed several times, at times being placed in Ternstroemiaceae, Dilleniaceae and its own family, Saurauiaceae. The island of New Guinea may be a centre of diversity for *Saurauia* in South East Asia with more than 50 species. No comprehensive treatment of New Guinean *Saurauia* has been attempted since the work of Diels in 1922, despite complaints by later researchers that this publication is out of date and the subdivisions of the genus proposed therein are unsatisfactory. A full account of the family, including *Saurauia*, has yet to be covered in Flora Malesiana. This paper presents an introduction to the genus *Saurauia* in New Guinea and communicates plans for future research.

Keywords. Actinidiaceae, New Guinea, *Saurauia*

The family Actinidiaceae

The family Actinidiaceae Gilg & Werdermann contains c. 355 species within three genera—*Actinidia* Lindl. (which includes the kiwi-fruit, c. 30 species), *Saurauia* Willd. (c. 300 species) and *Clematoclethra* (Franch.) Maxim. (c. 25 species). The family occurs in tropical and subtropical Central America, South America and South East Asia and also in temperate Asia and northern Australia (Heywood 2007). According to the Angiosperm Phylogeny Group (APG) 3 (Stevens 2001 onwards), Actinidiaceae sits in the order Ericales as a sister group to the families Roridulaceae and Sarraceniaceae.

Actinidiaceae is a family of trees, shrubs and woody lianas with alternate or spiral, simple leaves with entire or serrate margins and no stipules. Inflorescences are axillary, with few to many unisexual or hermaphroditic flowers with free or fused petals, 10 to many stamens which may be fused to the base of the petals and a superior ovary, usually with three to five carpels (Heywood 2007). Flowers are usually pentamerous but exceptions occur. In pentamerous flowers the aestivation is quincuncial (Dressler & Bayer 2004). Flowers are often white but can also be pink, red or yellowish brown. The fruit is a berry or (often in *Saurauia*) a capsule, usually containing many small seeds. Raphides occur in many plant parts (Dressler & Bayer 2004). Several species (of mainly *Actinidia*) are cultivated world-wide for their edible fruit and ornamental value.

The genus *Saurauia*

Saurauia, by far the largest genus in Actinidiaceae, occurs from Mexico southwards to Chile in the New World and then in the Old World from China to New Guinea (with one species in Queensland, northern Australia). They are conspicuously absent from Brazil and Africa. There are c. 60 species across Central and South America (Hunter 1966, Soejarto 1980), the remainder being found in the Old World.

Saurauia is a genus of small to medium trees and shrubs (sometimes scrambling). A prominent feature of many species of *Saurauia* is the distinctive indumentum of (often stiff) hairs and scales that cover many plant parts. In dried herbarium specimens, the indumentum is often chaffy and tan-coloured, making it easy to spot with a $\times 10$ hand-lens, and sometimes with the naked eye. The flowers of *Saurauia* may be subtended by a bract and two bracteoles (Dickson 1972). Sepals are connate at the very base, filaments are adnate to petals at the base; filament bases may be connate, forming a ring. Anther dehiscence is via poricidal slits.

Saurauia was first described by Carl Ludwig von Willdenow in 1801 and placed by him in the family Tiliaceae (Willdenow 1801). Two different spellings were used in this original publication—*Saurauia* on the description of the illustration plate and *Saurauja* in the main body of text—most likely due to a printing error (Hoogland 1977). Both were used for over 170 years until Hoogland's 1977 proposal, that *Saurauia* be conserved over *Saurauja*, was accepted.

Between Willdenow's 1801 publication and the present day *Saurauia* has been assigned by different authors to a number of different families—most commonly Ternstroemiaceae (now Pentaphylacaceae), Dilleniaceae and Saurauiaceae (Fig. 1). In 1972 Dickson provided evidence based on detailed studies of floral morphology and anatomy that *Saurauia* belonged in the family Actinidiaceae.

Saurauia in South East Asia and current status in New Guinea

Saurauia has yet to be treated for the Flora Malesiana series (*Actinidia* is the only genus in the family Actinidiaceae to have been covered so far; Steenis 1950). A revision of the Peninsular Malaysia taxa is currently in progress (Rafidah Rahman, pers. comm.) which will be the first for the Flora Malesiana region since Diels's (now outdated) treatment of the New Guinea taxa in 1922. Diels's classification, looking only at New Guinea species, divided the genus into 10 sections: *Uniflorae*, *Ramiflorae*, *Calyptratae*, *Squamulosae*, *Setosae*, *Armatae*, *Obtectae*, *Rufae* (also inconsistently referred to in the manuscript as *Tomentosae* by Diels), *Bibracteatae* and *Obvallatae*. The sections are divided mainly on inflorescence architecture, bract characters, and leaf, bract and sepal indumentum.

Gilg & Werdermann (1925) later adapted Diels's system to encompass other Old World species (no extra New Guinean taxa were added) and modified it by sinking seven of Diels's 10 sections into one, thus dividing the genus into four sections: *Uniflorae*, *Ramiflorae*, *Calyptratae* and *Pleianthae*. The seven sections of Diels sunk

into *Pleianthae* were retained as series.

These systems are now desperately outdated, as many more New Guinean species have been published (e.g., Diels 1929, Smith 1941, Kanehira & Hatusima 1943, Royen 1982, Takeuchi 2008) and authors have experienced difficulties in fitting new taxa into the generic framework laid down in the Diels (1922) and Gilg & Werdermann (1925) papers. Burt (1936) noted that under Gilg & Werdermann's system, several closely related Old World species fell into different sections, leading him to believe that the classification was largely artificial. The same has been noted specifically in New Guinea taxa, in *Saurauia trugul* P.Royen, for example. Royen (1982) noted that the pubescence of the bracts and sepals placed the species in series *Bibracteatae*, but the species showed a closer affinity to *Obvallatae*. More recent publications (e.g., Takeuchi 2008) continue to complain about this lack of clarity. Diels, Gilg and Werdermann were however aware of the limitations of their work, with Diels (1922) noting that "the series suggested are intended only as a preliminary grouping" and Gilg & Werdermann (1925) stating: "we believe that future monographic work will change and improve the groupings".

A search of Index Kewensis records, via the International Plant Names Index (2010) reveals that c. 100 taxon names have been published for New Guinea. The first two New Guinea taxa were published by Miquel in 1869. During the 20 years from 1922 to 1941, over 50 species were described (in Diels's 1922 paper he almost doubled the number of species known from New Guinea by publishing 24 species that were new to science). In contrast, less than 10 New Guinea species have been published in the more than 60 years since. Very little mention is made regarding synonymy in any of the papers on New Guinea taxa and it is possible that some of the 100 taxon names will be sunk as future research finds them to be conspecific. Royen (1982), for example, estimates there to be c. 50 species in New Guinea. *Saurauia* appears to be

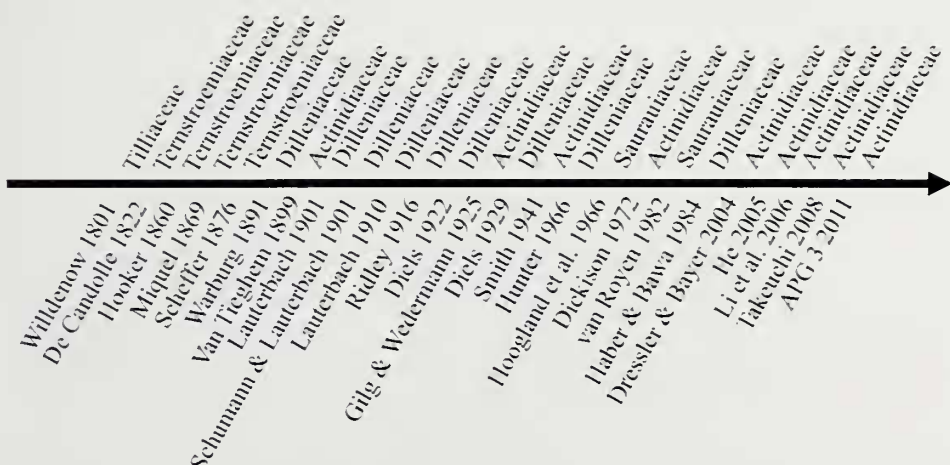


Fig. 1. A small selection of different family names under which *Saurauia* has been published.

particularly species-rich in New Guinea when compared with other areas: there are 6 species in Vietnam, 13 in China, 10 in Peninsular Malaysia (and the whole of the New World only has c. 60 species in total) (Cuong et al. 2007, Li et al. 2006, Rafidah Rahman, pers. comm. 2010, Hunter 1966 and Soejarto 1980, respectively). Many New Guinean *Saurauia* species appear to favour disturbed or partially disturbed habitats—the edges of clearings and trails for example. New Guinea is a very geologically active area, where frequent earthquake disturbances and landslips may provide a plethora of suitable habitats and may go some way to explaining the level of species diversity seen there.

Fig. 2 gives an overview of the number of taxon names published from New Guinea by year and, when considered alongside the fact that there is a substantial amount of indeterminate *Saurauia* material from New Guinea in herbaria around the world, suggests that the *Saurauia* of this region have been somewhat neglected in recent years. The reasons for this are perhaps manifold—the revisions are outdated—a significant number of species have been described since they were published and these new taxa are not included in the keys. There may also be a significant number of new species yet to be recognised as such. Smith (1941) noted that only a few *Saurauia* species (usually those occurring in lowland rain forest) were abundant, with most taxa from altitudes higher than 1200 m occurring in very narrow ranges. Many of the indeterminate specimens have been collected from high altitude areas previously not researched botanically.

Saurauia in New Guinea have long since been considered a ‘difficult’ group to work with due to the lack of a solid and taxonomically sound generic framework around which new taxa can be added. There is no definite understanding of which characters are taxonomically significant. Recent studies on New World taxa (by Soejarto in 1980), however, are promising and may hold the key to bringing a sense of order to the New Guinea taxa. The distribution of indumentum on sepals and also the type of indumentum on different plant parts has been found to be taxonomically significant. This may also be true of the New Guinea taxa where a wide variety of

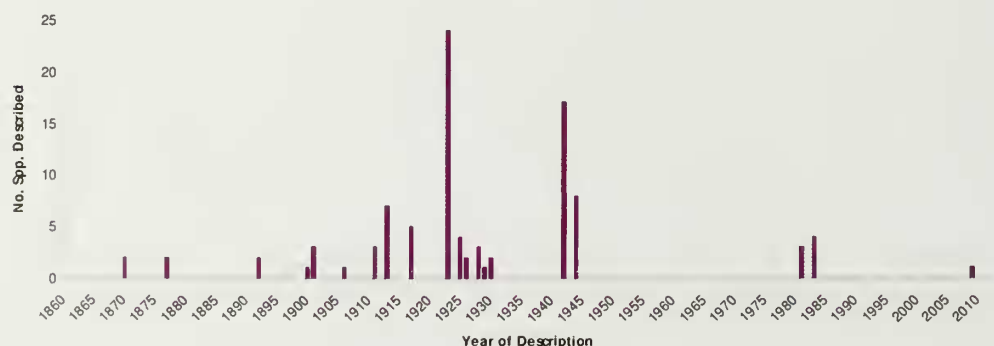


Fig. 2. The number of *Saurauia* species described for New Guinea each year, the first by Miquel in 1869, the last by Takeuchi in 2008.

indumentum is evident and should be a consideration of any future research on the group in New Guinea.

The long reaching aim of future work on *Saurauia* taxa from New Guinea will be to look for taxonomically significant characters that can be used to identify species, to write a comprehensive key to the species and to get an overview of how these species relate to others in the Flora Malesiana region. No molecular studies have been published to date and such work may yield useful information when looked at in parallel with morphological studies. There is evidently much to learn about the genus *Saurauia* in New Guinea and it is hoped that, with careful research and access to herbarium specimens, DNA samples, field notes and photographs, definite progress towards these aims can be made.

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